

A New Species of *Gastropteron* from Florida (Gastropoda: Opisthobranchia)

by

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Abstract. The morphology and biology of *Gastropteron vespertilium* Gosliner & Armes, spec. nov., from Tampa Bay, Florida, are described. A detailed comparison of *G. vespertilium* with *G. rubrum* (Rafinesque, 1814) is provided, and consistent differences are noted.

INTRODUCTION

MEMBERS OF the Gastropteridae are widely distributed throughout the world's oceans. Only 3 of the 20 described species have been recorded from the Atlantic Ocean (Gosliner, in press), with only a single species known to occur in the western Atlantic (MARCUS, 1977).

In April, 1970, one of us (PTA) discovered a population of an undescribed species of *Gastropteron* from intertidal mudflats in Tampa Bay, Florida. Repeated observations have been made in successive years. This paper describes aspects of the morphology and biology of this species and discusses its systematic placement.

All figures, unless otherwise indicated were prepared by one of us (TMG).

DESCRIPTION

Gastropteron vespertilium
Gosliner & Armes, spec. nov.

Type material: (1) Holotype: National Museum of Natural History, Washington, D.C., USNM 809992, 1 specimen, swimming at surface, Bunces Pass, Tampa Bay, Pinellas County, Florida, 1 February 1970, collected by C. Powell. (2) Paratype: USNM 809993, one dissected specimen with radular slide, Bunces Pass, Tampa Bay,

Florida, 1 February 1970, C. Powell. (3) Paratype: USNM 809994, one dissected specimen, slides of radula, penis and reproductive organs, Bunces Pass, Tampa Bay, Florida, 1 February 1970, C. Powell.

Etymology: The specific epithet is derived from the Latin *vespertilio*, meaning "bat." When it is swimming by flapping its parapodia, *Gastropteron vespertilium* resembles a bat.

Distribution: Specimens have been found at only four localities (Figure 1): Boca Ciega Inlet, Capri Island, the north end of the Skyway Bridge, and Bunces Pass, all within the vicinity of Tampa Bay, Florida.

External morphology: The living animals (Figures 2 to 5) are 3-5 mm in length and may reach 8 mm in width when the parapodia are fully opened. The ground color of the head, parapodia, and foot of the living animals varies from charcoal-gray to purplish black. A line of brilliant yellow is generally present around the margins of the parapodia and siphon. In some specimens the margin is greenish or pale blue, with scattered blue-gray spots on the parapodia. The flagellar appendage is charcoal-gray basally and translucent white with occasional spots of gray in its apical half. The head shield is triangular, slightly emarginate antero-medially. Its posterior end is folded to form a simple tubular siphon. The parapodia are thin and fleshy. The foot (Figure 7) is broad and extends posteriorly behind the parapodia. Its posterior limit is trian-

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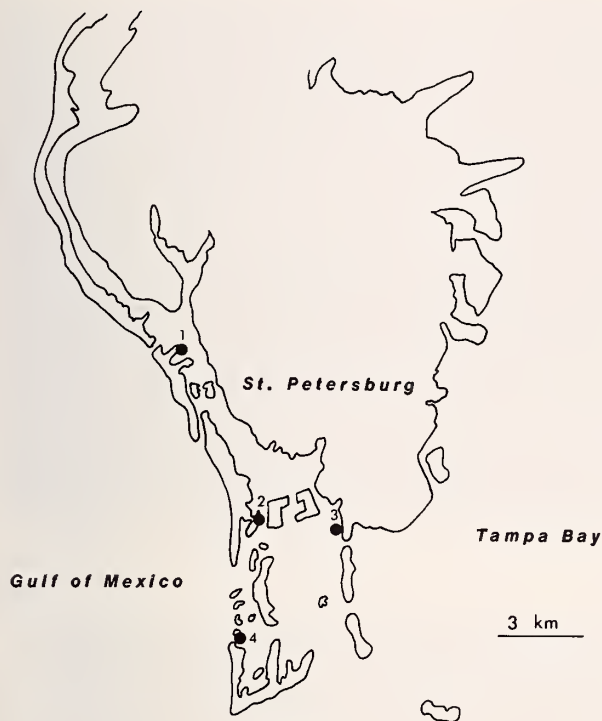


Figure 1

Collecting localities of *Gastroteron vespertilium* spec. nov.: 1, Capri Island; 2, Boca Ciega Inlet; 3, north end of Sunshine Skyway Bridge; 4, Bunces Pass.

gular and acute. Anteriorly, the foot is emarginate. A pedal gland empties by means of an elongate groove at the posterior limit of the foot.

The gill (Figure 8) is situated on the right side of the body and consists of 9 to 11 simply plicate leaflets. The anus is situated immediately posterior to the gill. The hermaphroditic gonopore is anterior to the gill and empties into the sperm groove, which transports endogenous sperm to the male gonopore on the right side of the head. The flagellum (Figures 2, 3, and 8) is situated on the right side of the body and when fully extended may equal half of the body length. Frequently the flagellum is partially or completely retracted and may be entirely enveloped by the parapodia.

Shell: The weakly calcified, hyaline shell (Figures 6 and 23A) is 350 μm in length and consists of approximately two complete whorls.

Digestive system: The buccal mass is elongate and highly muscular. The radula sac is situated at the posterior limit of the buccal mass. In the anterior portion of the mass is a thin labial cuticle which possesses several rows of minute polygonal platelets (Figure 9). The radula (Figures 10 to 15) is well developed with a formula of $15-21 \times 5-6.1.0.1.5-6$. The inner lateral teeth possess 17-25 minute

denticles. The outer lateral teeth lack denticles and gradually decrease in size toward the outer margin of the radula.

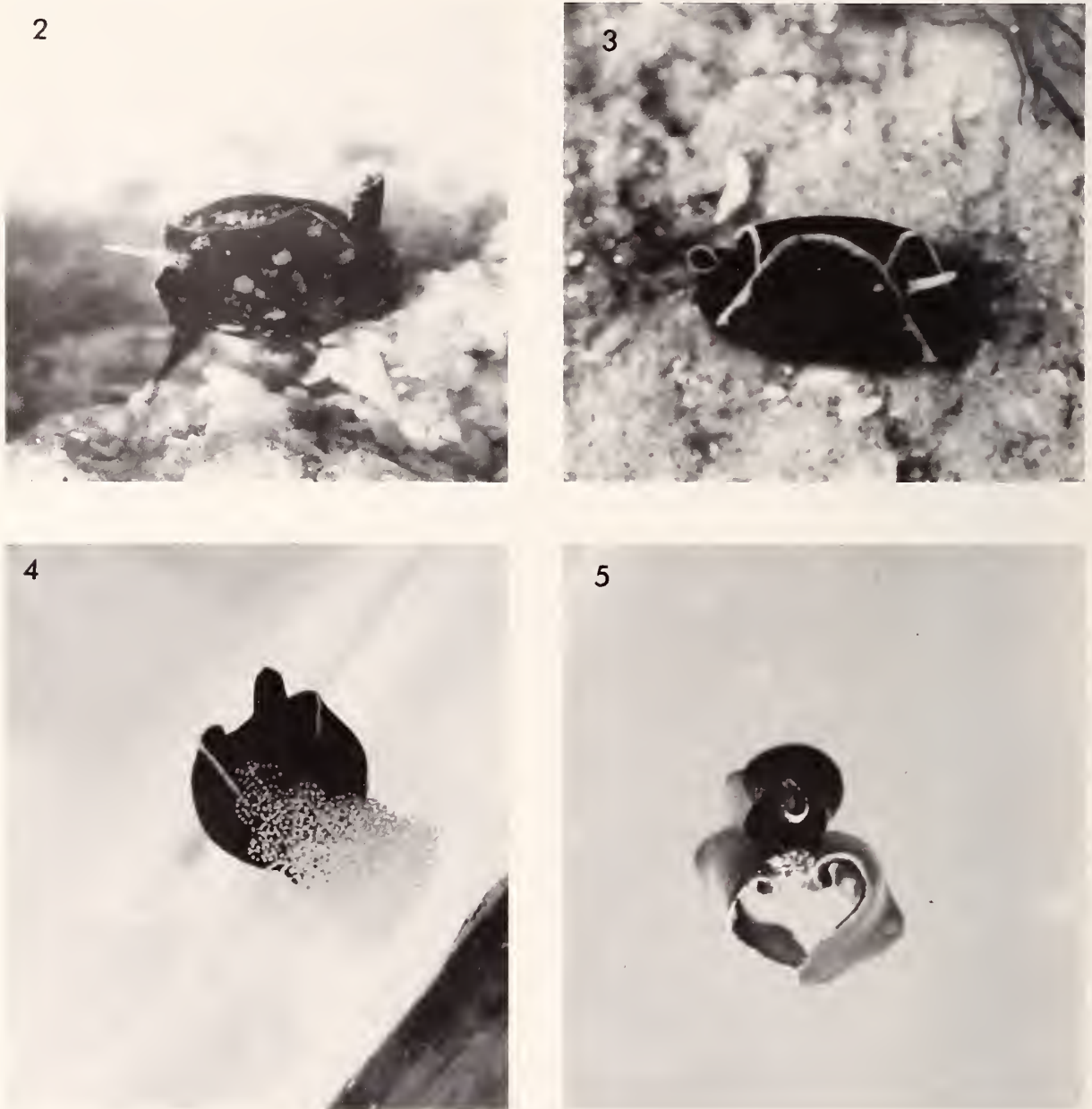
Central nervous system: All of the ganglia are contained within a circum-esophageal nerve ring (Figure 16). The cerebral ganglia are separated by a short commissure. Anteriorly, each cerebral ganglion gives rise to an enlarged area and subsequently bifurcates into two nerves. The pedal ganglia are joined by a commissure that is slightly more elongate than the cerebral commissure. Adjacent to the left cerebral ganglion is the left pleural ganglion, which is also joined to the left pedal ganglion. The subintestinal and visceral ganglia are adjacent to the left pleural ganglion. From the visceral ganglion the visceral loop passes ventral to the esophagus and curves anteriorly to the suprainintestinal ganglion on the right side of the nerve ring. The suprainintestinal ganglion is adjacent to the right pleural ganglion.

Reproductive system: The ovotestis is situated at the posterior end of the visceral hump. From there a narrow convoluted ampulla (Figure 17) is directed anteriorly. It winds around the female gland mass and joins the duct of the bursa copulatrix and the female gland mass at the hermaphroditic gonopore. The ampulla lacks a distinct receptaculum seminis in the two specimens examined. The albumen and membrane glands are small and difficult to discern, while the mucous gland comprises the bulk of the female gland mass. The bursa copulatrix is spherical. The penis (Figure 18) consists of an elongate prostate which is thick and sharply curved. On the inner side of the posterior end of the prostate is a spherical spermatic bulb that joins the prostate by means of an elongate duct. The penial papilla is short and rounded with a bilobed apex.

NATURAL HISTORY AND BEHAVIOR

Gastroteron vespertilium has been found only in the vicinity of Tampa Bay. The three specimens that comprise the type series were collected in early February, but the numerous specimens collected at Boca Ciega Bay were all found in April in several successive years. During April the animals were abundant and occurred with egg masses. By early May the population had entirely disappeared. It is likely that the animals come into shallow water to breed. This also is true for the nudibranch *Dendronotus iris* along the California coast (TMG, personal observation), which normally inhabits subtidal flats but is found commonly in the intertidal during summer months when it is breeding. It is interesting to note that both of these opisthobranchs have remarkable natatory capabilities which facilitate their transport.

Gastroteron vespertilium is found on intertidal sand flats amid scattered plants of shoal grass, *Diplanthera wrightii* Escher. The animals commonly crawl along the surface of the substratum and occasionally burrow, but like most known members of the Gastropteridae, they are



Explanation of Figures 2 to 5

Gastropteron vespertilium spec. nov. Figure 2. Lateral view (photograph by Rod Armes). Figure 3. Dorsal view (photograph by Patricia Armes). Figure 4. Animal depositing egg mass (photograph by Patricia Armes). Figure 5. Animal swimming (photograph by Rod Armes).

also capable of swimming for prolonged periods (Figure 5). The animals swim by dorsal-ventral flapping of the parapodia. The body is sometimes upright, but more frequently inverted while swimming. Swimming is erratic, characterized by rapid circling and darting. While swimming, the animals often protrude the buccal region and a white, viscous fluid is secreted. Little is known about feed-

ing in the Gastropteridae, but the remains of minute crustaceans were found in the stomach of several specimens of *G. vespertilium*.

Extensive laboratory and field observations were made of individuals undergoing copulation and egg deposition. Copulation lasted 5-10 min in the pairs observed. The egg mass (Figure 4) emerges from the hermaphroditic



Figure 6

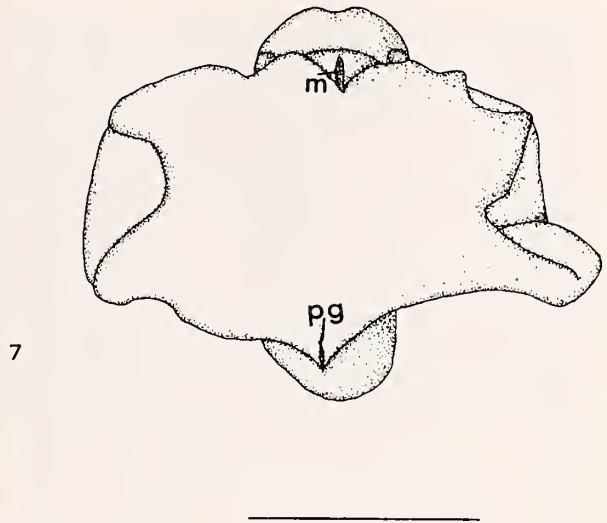
Shell of *Gastropteron vespertilium* spec. nov. Scale = 175 μ m (drawing by Sally D. Kaicher).

gonopore as a single strand of eggs enveloped by a coating of mucus. There is generally a single yellowish egg per capsule. Sixteen to twenty capsules are emitted at a rate of one per second, followed by a three to four second pause before another strand emerges. This procedure may continue for 20 min to an hour. The strands are formed into a spherical mass, which is variable in size. Veliger larvae hatched within three or four days of egg deposition.

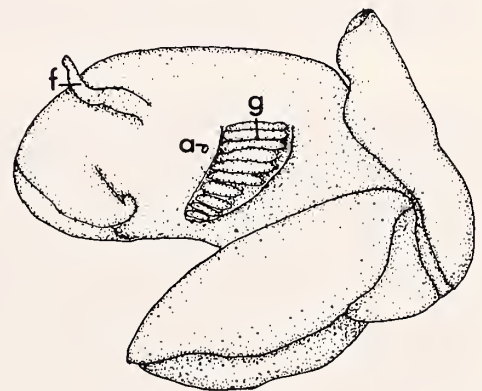
When touched and seriously disturbed, specimens of *Gastropteron vespertilium* exude a bright greenish-yellow fluid that leaves a persistent yellow-orange stain that is soluble in alcohol but not in water. While trying to relax animals for fixation, it was determined that they could withstand temperatures as low as 0°C for 15 min and still revive. They died when the temperature was lowered to -1°C for the same period.

DISCUSSION

The species of Gastropteridae are readily distinguishable on the basis of the external morphology and coloration of the living animal. *Gastropteron vespertilium* can be differentiated from all other described members of the family by its dark-gray or blue-black color. *Gastropteron vespertilium* is placed in *Gastropteron* by virtue of its radula, which contains five or six outer lateral teeth per half row. Of the 14 previously described species of *Gastropteron* only four, *G. citrinum* Carlson & Hoff, 1974, *G. fuscum* Baba & Tokioka, 1965, *G. ladrones* Carlson & Hoff, 1974, and *G. rubrum* (Rafinesque, 1814), possess a single elongate flagellum on the right side of the body, as in *G. vespertilium*. The first three species possess a vestigial gill and only *G. vespertilium* and *G. rubrum* have an elongate flagellum and a well-developed gill. *Gastrop-*



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Explanation of Figures 7 and 8

Gastropteron vespertilium spec. nov. Scale = 1.0 mm. Figure 7. Ventral view: m, mouth; pg, pedal gland. Figure 8. Right lateral view: a, anus; f, flagellum; g, gill.

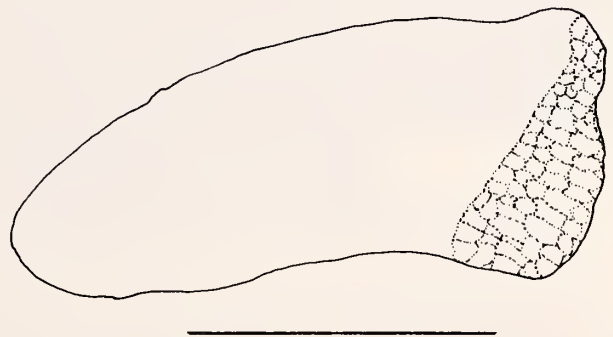
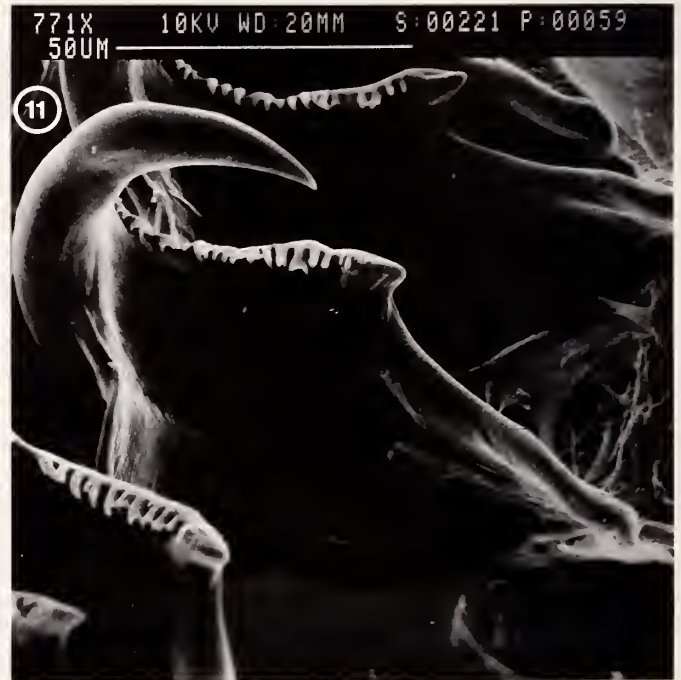


Figure 9

Jaw of *Gastropteron vespertilium* spec. nov. Scale = 0.25 mm.



Explanation of Figures 10 to 13

Gastropteron vespertilium spec. nov. Scanning electron micrographs of radular teeth. Figure 10. Entire radular width. Figures 11 to 13. Inner lateral teeth from various angles.

teron rubrum is also the only other species of the family known from the western Atlantic (MARCUS, 1977). For these reasons a detailed comparison of *G. rubrum* and *G. vespertilium* is provided. In addition to records of *G.*

rubrum from the literature (VAYSSIÈRE, 1880, 1885; BERGH, 1893; GUIART, 1901; MARCUS & MARCUS, 1966; SALVINI-PLAWEN & ABBOTT, 1974), specimens from Palermo, Italy (four specimens, Museum National d'His-

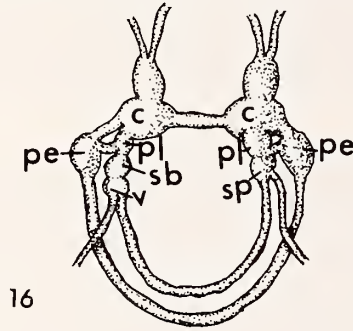


Explanation of Figures 14 and 15

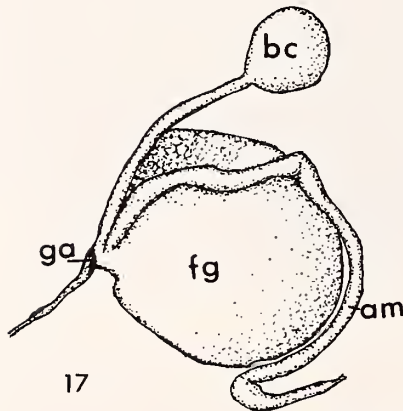
Gastropteron vespertilium spec. nov. Scanning electron micrographs of radular teeth. Figure 14. Half rows of teeth. Figure 15. Outer lateral teeth.

Table 1
Morphological comparison of *Gastropteron rubrum* and *G. vespertilium*.

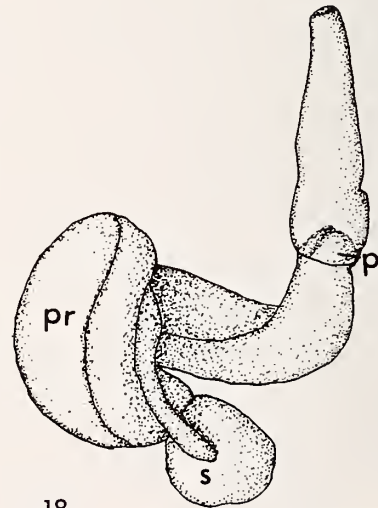
	Reference, locality	# of gill lamellae	Radular formula	# denticles on inner lateral	Prostate	Spermatic bulb
<i>Gastropteron rubrum</i>	VAYSSIÈRE, 1880, 1885 Mediterranean	—	40X5.1.0.1.5.	26	elongate	absent
<i>Gastropteron rubrum</i>	BERGH, 1893 Naples	25-30	20-23X5.10.1.5.	4-18	elongate	absent
<i>Gastropteron rubrum</i>	MARCUS, 1960; present study Bear Cut, Key Biscayne	11	17X5-6.1.0.1.5-6.	15-18	elongate	absent
<i>Gastropteron rubrum</i>	present study Grand Cayman Is.	10	20X5-6.1.0.1.5-6.	16-28	elongate	absent
<i>Gastropteron rubrum manx</i>	MARCUS & MARCUS, 1966; present study Gulf of Guinea	23	23X5.1.0.1.5.	18-26	elongate	absent
<i>Gastropteron vespertilium</i>	present study Tampa Bay	9-10	15-27X5.6.1.0.5-6.	17-25	short	present



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18

Explanation of Figures 16 to 18

Gastropteron vespertilium spec. nov. Scale = 1.0 mm. Figure 16. Central nervous system: c, cerebral ganglion; pe,



Explanation of Figures 19 and 20

Figures 19 and 20. *Gastropteron rubrum* (Rafinesque, 1814). Radular teeth of specimen from Grand Cayman Island. CASIZ 034121.

pedal ganglion; pl, pleural ganglion; sb, subintestinal ganglion; sp, suprainstestinal ganglion; v, visceral ganglion.
 Figure 17. Reproductive system: am, ampulla; bc, bursa copulatrix; fg, female gland mass; ga, genital aperture.
 Figure 18. Penis: p, penis; pr, prostate, s, spermatic bulb.



Explanation of Figures 21 and 22

Figures 21 and 22. *Gastropteron rubrum* (Rafinesque, 1814). Radular teeth of specimen from Bear Cut, Key Biscayne. USNM 836667.

toire Naturelle, Paris), Grand Cayman Island (one specimen, California Academy of Sciences, San Francisco, CASIZ 034121, Grand Cayman Island, Seven Mile Beach, Caribbean Club, 150 m off shore, just below surface, col-

lected by James E. Sutton, 30 June 1974) and Miami, Florida (one specimen, National Museum of Natural History, USNM 836667, Bear Cut, Biscayne Bay, collected by Sandra Maxwell, 21 May 1966) were examined.

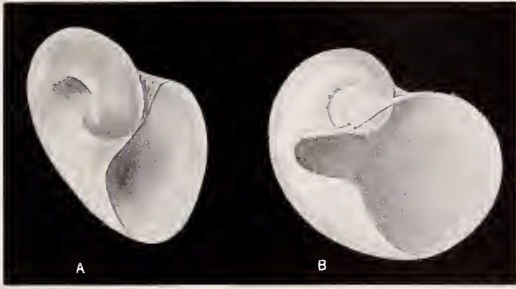


Figure 23

Shells. A. *Gastropteron vespertilium* spec. nov. B. *Gastropteron rubrum* (Rafinesque, 1814), after Vayssière, 1885. Not to scale (drawing by Sally D. Kaicher).

The holotype of *G. rubrum manx* Marcus & Marcus, 1966 (National Museum of Natural History, Washington, USNM 576262, Gulf of Guinea, R.V. Pillsbury station 241) was also reexamined.

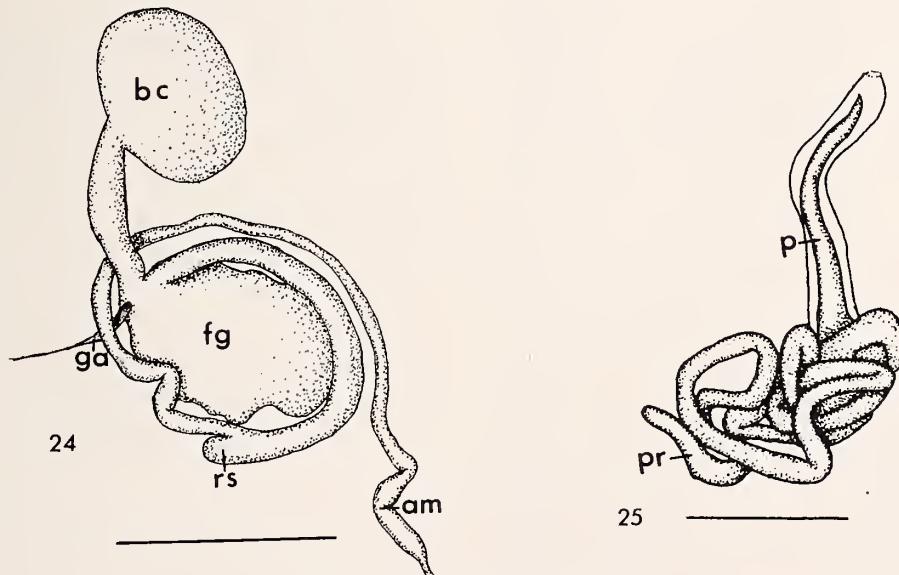
The present material of *Gastropteron rubrum* is well within the range of variation previously described for the species, with a few minor exceptions (Table 1). In one specimen there were as many as 28 denticles on the inner lateral tooth and in another specimen there were only 17 rows of radular teeth. The two western Atlantic specimens have 10 or 11 gill filaments which is fewer than previously reported.

Gastropteron vespertilium is exceedingly similar to *G. rubrum* in much of its external and internal morphology.

Gastropteron vespertilium is reproductive at 3 mm in length and reaches a maximum length of 5 mm. The two small individuals of *G. rubrum* from the western Atlantic were 2.5 and 3 mm in length, but were not fully mature. The penis was well developed but the female gland mass had not yet undergone differentiation. *Gastropteron rubrum* is known to reach a length of 24 mm (VAYSSIÈRE, 1880). The jaws and radulae of *G. vespertilium* and *G. rubrum* provide little basis for the separation of the species (Figures 10 to 15 and 19 to 22). There is considerable overlap in radular formulae and in the number of denticles on the inner lateral teeth. The number of gill filaments is similar in *G. vespertilium* and in specimens of *G. rubrum* of comparable size. The central nervous system is virtually identical in both species (VAYSSIÈRE, 1880; BERGH, 1893; present study).

The major differences between *Gastropteron vespertilium* and *G. rubrum*, other than the obvious and consistent differences in coloration, are in the shape of the shell and the reproductive morphology. In *G. vespertilium* the inner margin of the shell (Figure 23) is entire, whereas in *G. rubrum* there is a deep sinus.

The reproductive system has been completely described in only three species of *Gastropteron* (GUIART, 1901; MACFARLAND, 1966; GOSLINER, in press). In *G. rubrum* a semi-serial receptaculum seminis is absent but a serial receptaculum, which appears as a swelling of the hermaphroditic duct (Figure 24), is present in all described material (BERGH, 1893; GUIART, 1901; present study). In the two specimens of *G. vespertilium* that we examined, the hermaphroditic duct lacks either a serial or semi-serial



Explanation of Figures 24 and 25

Gastropteron rubrum (Rafinesque, 1814). Figure 24. Reproductive system: am, ampulla; bc, bursa copulatrix; fg, female gland mass; ga, genital aperture; rs, receptaculum seminis. Scale = 2.0 mm. Figure 25. Penis: p, penis; pr, prostate. Scale = 3.0 mm.

receptaculum and is of a uniform diameter throughout its length.

The structure of the penis also differs significantly between the two species (Figures 17 and 25). In *Gastropteron rubrum* (BERGH, 1893; GUIART, 1901; MARCUS & MARCUS, 1966) there is a narrow elongate prostate that consists of numerous convolutions. The penial papilla is elongate and conical. In *G. vespertilium* the prostate is thick and curved, but not convoluted. A distinct spermatid bulb is present. The penial papilla is exceedingly short and bifid at its apex.

Despite the similarities between *Gastropteron vespertilium* and *G. rubrum* in many aspects of their external and internal anatomy, the striking differences in coloration and the morphology of the shell, hermaphroditic duct, and penis ensures that they are distinct species. Although both species are found in the western Atlantic of Florida, they may not be sympatric. *Gastropteron rubrum* is known from the Atlantic coast of Florida to Brazil, but no confirmed reports exist from the Gulf of Mexico. *Gastropteron vespertilium* has only been collected in Tampa Bay, on the Gulf coast of Florida, but is likely to be more widespread.

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